

AMENDED FY 1988/FY 1989 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: 0303603F
DOD Mission Area: 333 - Strategic Communications

Title: Milstar Satellite Communications System
(Space and Mission Control)
Budget Activity: 3 - Strategic Programs

1. RDT&E RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1987 Actual	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		456,605			Continuing	N/A
2932	Milstar	456,605			Continuing	N/A

2. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Milstar Satellite Communications System program is a joint service program to develop and acquire the Milstar Extremely High Frequency (EHF) satellite, its mission control segment, and new or modified communications terminals. The Milstar system will provide a highly survivable, jam-resistant, world-wide, secure communications system to meet the minimum essential wartime communications needs of the President and Commanders-in-Chief to command and control selected Air Force strategic and tactical forces through all levels of conflict. It will also support other high priority users in crisis/contingency situations. This Program Element funds for development of the Milstar satellite and its associated Mission Control Elements (MCE).

3. (U) COMPARISON WITH FY 1988/FY 1989 DESCRIPTIVE SUMMARY: (\$ in thousands)

RDT&E	470,316	366,095	257,322	Continuing	N/A
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EXPLANATION: (U) FY 1987 - Assessment for Congressional undistributed reductions. FY 1988 - Congressional action to accelerate out year satellite acquisition and launch schedule as discussed in the classified annex to the FY 1988 Congressional conference report. FY 1989 - Increase required to comply with FY 88 Congressional language.

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

5. (U) RELATED ACTIVITIES: The Air Force has total system development responsibility, heads the Joint Milstar Program Office and manages the development and acquisition of the space and mission control segments. Each Service manages a terminal program (Air Force for airborne and selected ground, Navy for shipborne and selected ground, and Army for ground) under the orchestration of the Milstar Joint Terminal Program Office managed by the Navy (PE 0303603N).

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The Milstar program was initiated in FY 1982 with funds in the Space Communications program (PE 0603431F) and Air Force Satellite Communications System (AFSATCOM) (PE 0303601F). The Milstar Satellite Communications System (PE 0303603F) was created in the FY 1983 President's Budget submission and contained both satellite and terminal development funds. However, beginning in FY 1984, Air Force Extremely High Frequency (EHF) terminal development is funded in Milstar Satellite Communications System (Air Force Terminals) (PE 0303601F), formerly AFSATCOM, and the Milstar satellite and Mission Control Element (MCE) development is funded in Milstar Satellite Communications System (Space and Mission Control) (PE 0303603F). This is consistent with all other DOD Satellite Communications (SATCOM) development and production programs. In addition to developing the new Milstar satellite, the Air Force is also managing the development and acquisition of the EHF applique packages for Fleet Satellite Communications vehicles F-7 and F-8 which are funded in the Navy's EHF SATCOM (PE 0604577H). The Army and Navy terminals are funded under Satellite Communications Ground Environment (PE 0303142A) and EHF SATCOM (PE 0604577H and 0303109H) respectively. Air Force Ground Mobile Forces (GMF) terminals are being funded under Satellite Communications Terminals (PE 0303605F). Development of Titan IVs to provide assured access to space for Milstar is funded in Space Boosters (PE 0305119F).

6. (U) WORK PERFORMED BY: The development of the Milstar satellite and the MCE for the Milstar system is managed by Air Force Systems Command's Space Division, Los Angeles AFB, CA. The contract for Full Scale Development of the Milstar satellite and MCE was awarded on 30 June 1983. The prime contractor is Lockheed Missiles & Space Co., Sunnyvale, CA. Subcontractors to Lockheed include: Hughes Aircraft Co., El Segundo, CA (crosslink and frequency and time standards subsystems); TRW, Inc., Redondo Beach, CA (payload subsystem); General Electric Co., Valley Forge, PA (data handling subsystem); and Ford Aerospace Communications Corporation, Palo Alto, CA (crosslink receivers). The Aerospace Corporation, El Segundo, CA, provides general system engineering and integration.

7. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1989: Not Applicable.

8. (U) SINGLE PROJECT OVER \$10 MILLION IN FY 1989:

(U) Project: #2932, Milstar Satellite Communications System (Space and Mission Control)

A. Project Description: This program designs, fabricates, tests, and acquires the Milstar EHF satellite consisting of the mainframe (or "bus"), the communications payload, antenna suite and the MCE. The system will incorporate state-of-the-art techniques for jam-resistance and survivability. Key features include higher frequencies, bandspreading, on-board signal processing, end-to-end encryption, hardening, [] a high degree of autonomy and on-orbit storage. A special endurance feature of Milstar is the MCE which will allow selected command terminals located on survivable platforms to control the satellite/system. An Ultra High Frequency (UHF) package will provide backward compatibility with existing UHF systems and facilitate the transition to EHF. This program will provide world-wide, two-way, jam-resistant, secure, highly survivable and enduring communications capability.

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B. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1987 Accomplishments: The primary effort was the fabrication and testing of the DFS-1 and its communications payload. Long lead parts acquisition for DFS-3 continued, and the fabrication option was exercised. Fabrication of DFS-1 and DFS-2 continued. The system level Critical Design Review (CDR) for the space segment and subsystem level CDRs for the mission control segment were conducted. Major emphasis was placed on integration of the satellite with the Centaur Upper Stage and then integration of the spacecraft and Centaur with the Titan IV. Development of system level end-to-end test plans were completed and initial system level testing began. Preliminary planning for Initial Operational Test and Evaluation (IOT&E) of the Mission Control Element (MCE) began on ground mobile platforms.

(2) (U) FY 1988 Program: The basic program includes completion of the final bus assembly for DFS-1, initial integration of the payload onto the spacecraft, continued fabrication of DFS-2 and DFS-3. Option to purchase long lead parts for DFS-4 will be exercised. Compatibility testing between communications payload and Service terminals will be conducted. The system level CDR will be conducted for the MCE. IOT&E planning for the MCE will continue, and platform design work will be conducted for future installation of engineering development model MCEs. Launch system integration of the Milstar spacecraft with the Titan IV will continue. An Independent Cost Analysis (ICA) will be completed on the space and mission control portions of the program.

(3) (U) FY 1989 Planned Program and Basis for FY 1989 RDT&E Request: DFS-1 hardware and software integration will continue. Bus and payload integration will continue. Qualification testing and system level acceptance testing will continue. Fabrication of DFS-2 and DFS-3, and long lead parts acquisition for DFS-4 will continue. The fabrication option for DFS-4 will be exercised to comply with FY 88 Congressional direction to accelerate program. Cost estimates are mature, Category II and based on current contract awards, an update to the ICA for the satellite and MCE completed in November 1984, a Single Best Estimate for the satellite and MCE completed in November 1986, and the ICA completed in March 1988.

(4) Program to Completion: This is a continuing program. Development work will continue on the satellite and MCE with launch of DFS-1 scheduled for early [] (Developmental satellites two through five will be launched by []) All satellites will be launched solely using Titan IVs and Centaur Upper Stages. Satellite production, commencing with satellite number six, is scheduled to begin in FY 1992. Installation of engineering development model MCEs will begin in FY 1990. Installation of production MCEs will begin in FY 1994.

C. (U) Major Milestones:

	<u>Milestones</u>	<u>Dates</u>
(1)	(U) Program Start	April 1981
(2)	(U) Start Concept Validation Phase	March 1982

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C. (U) Major Milestones: (continued)

(3) (U) Full Scale Development Contract		June 1983
(4) (U) Satellite Payload Preliminary Design Review (PDR)		July 1984
(5) (U) Satellite System PDR		November 1985
(6) (U) Start Fabrication of Developmental Flight Satellite #1 (DFS-1)		September 1986
(7) (U) Satellite System Critical Design Review (CDR)		July 1987
(8) () Delivery of satellite to launch facility	*(FY 1987)	
(9) () Launch of DFS-1		
(10) () Initial Operational Capability		
(11) () Full Operational Capability		

* Date presented in FY 1988 /89 Descriptive Summary.

(U) Explanation of Milestone Changes

(7) (U) Satellite CDR completed in July 1987.
(8 & 9) (U) Delivery and launch of satellite slipped because of necessity for simultaneous availability of satellite, terminals, booster and pad.

9. (U) COOPERATIVE AGREEMENTS: Not Applicable.

Program Element: 0303603F, Milstar Satellite Communications System (Space and Mission Control)Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The Full Scale Development contract for the Space and Mission Control Segments was awarded in FY 83 and DT&E has started.

(U) Test Schedule

- () Satellite and Mission Control Element (MCE)
Part/Circuit/Box Level Survivability Tests
- () Interface Tests - Payload to Terminal
 - MCE to Satellite
 - MCE to Air Force Terminal
- () System Level End-to-End Tests (Performance, Survivability, Interoperability)
- () On-Orbit DT&E Tests

(U) In December 1986, Navy Fleet Satellite F-7 was launched carrying the first Fleet Satellite Communications (FLTSATCOM) Extremely High Frequency (EHF) Package (FEP). The FEP is a scaled down version of the Milstar EHF payload. Following satellite checkout, the FEP payload commanding, telemetry, and communications signal processing using the FEP earth coverage and spot beam was successfully checked out by an Air Force/Navy/Lincoln Lab team.

(U) Field testing on the Navy terminal began in May 1987 using a destroyer, submarine, and shore station with the on-orbit FEP and the Navy satellite simulator. Major test objectives accomplished included evaluation of antenna pointing, baseband interfaces, network protocols, anti-jam/low probability of intercept, submarine dual band antenna integration, and platform integration.

(U) The Air Force Ultra High Frequency (UHF) transition terminal and Milstar UHF payload subsystem uplink and downlink waveform compatibility was successfully demonstrated. An Air Force Full Scale Development (FSD) Airborne Command Post (ABNCP) terminal was successfully tested with the prototype FEP located at Lincoln Lab. Demonstrated functions included uplink/downlink acquisition, network protocols, network setup, and voice communications using the Advanced Narrowband Digital Voice Terminal (ANDVT).

(U) Milstar is a joint service program with participation by all services. The Air Force has been designated Executive Agent for Milstar. The Joint Milstar Program Office provides overall management of the Milstar program and

Budget Activity: 3, Strategic Programs

Program Element: 0303603F, Milstar Satellite Communications System (Space and Mission Control)

is located at Air Force Systems Command's Space Division in Los Angeles, CA. The Space and Mission Control Segments of the Milstar program are managed from Space Division. The Terminal Segment efforts are orchestrated by the Joint Terminal Program Office (JTPO) which is a part of the Navy's Space and Naval Warfare Systems Command in Washington, DC (Program Element [PE] 0303603N). The JTPO provides guidance and system engineering support to each service terminal program office. The Air Force terminal program office is located at Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA. The Air Force terminal program is discussed in the Test and Evaluation Data Sheet for PE 0303601F, Milstar Satellite Communications System (Air Force Terminals). The Navy terminal program office is located at Space and Naval Warfare Systems Command's Navy Extremely High Frequency (EHF) Satellite Communications Terminal Program Office, Washington, DC. The Navy Milstar terminal effort is contained in PE 0604577N and PF 0303109N. The Army terminal program office is located in Communications-Electronics Command's Single Channel Objective Tactical Terminal Project Office, Fort Monmouth, NJ. The Army Milstar terminal effort is contained in PE 0303142A. Space Division is responsible for Developmental Test and Evaluation (DT&E) of the Space and Mission Control Segments of the Milstar system. The responsible agency for the Space and Mission Control Segments Initial Operational Test and Evaluation (IOT&E) is the Air Force Operational Test and Evaluation Center (AFOTEC). Air Force Space Command is designated the system operator and will be responsible for operation of the Milstar satellite constellation as well as Mission Control Segment. Air Force Logistics Command will be responsible for the Mission Control Segment maintenance.

(U) Lockheed Missiles and Space Company, Sunnyvale, CA, is under contract to Space Division for the general systems engineering and the Space and Mission Control Segments. The Air Force airborne and ground communications terminals are being developed by Raytheon in Sudbury, MA. The Navy's seaborne terminals are being developed by Raytheon in Sudbury, MA. The Army terminals are being developed by Magnavox, Ashburn, VA.

2. (U) Operational Test and Evaluation (OT&E):

(U) Responsible Organizations: Two IOT&E activities will be funded under this program element. First, AFOTEC will conduct an IOT&E of the Milstar Mission Control Segment. Second, a multiservice IOT&E of the overall system will be conducted. AFOTEC has been designated the lead agency for conducting this multiservice IOT&E program. AFOTEC, the Army Operational Test and Evaluation Agency (OTEA), and the Navy Commander, Operational Test and Evaluation Force (COMOPTEVFOR), will participate in the multiservice IOT&E which will take place as a combined Development Test and Evaluation (DT&E)/OT&E effort. A multiservice test team will be formed with representatives from Air Force, Army, Navy, and the Defense Nuclear Agency (DNA) to conduct the IOT&E testing.

(U) Mission Control Element (MCE) OT&E. AFOTEC will conduct OT&E of the MCE. The OT&E will consist of an operational assessment to support a planned Low Rate Initial Production (LRIP) decision and dedicated OT&E to support the full scale production decision. The operational assessment will involve monitoring both in-plant and field DT&E testing. The assessment will estimate the MCE's capability to satisfy operational requirements. Following the assessment, AFOTEC will conduct dedicated OT&E to evaluate the MCE's operational effectiveness and suitability against operational thresholds. The dedicated OT&E will involve field test of three production representative MCEs controlling the first on-orbit Milstar satellite. The three MCEs will be in representative operational environments on fixed and ground mobile platforms and will be operated and maintained by military personnel.

(U) Multiservice Operational Test and Evaluation (OT&E). Air Force Operational Test and Evaluation Center (AFOTEC), (the lead Service), Army Operational Test and Evaluation Agency (OTEA), and Navy Commander, Operational Test and Evaluation Force (COMOPTEVFOR) will jointly plan the multiservice Initial OT&E (IOT&E) which will take place as dedicated IOT&E. This IOT&E will be conducted by a multiservice test team directed by an Air Force O-6 (Colonel) and be comprised of Air Force, Army, and Navy test teams. The multiservice OT&E will evaluate the overall Milstar system from the perspective of its capability to satisfy end-to-end mission communications requirements. Testing will be conducted on a representative system consisting of the first two and then three on-orbit Milstar satellites; Air Force, Army, and Navy terminals; and an operational mission control segment including constellation control stations and the Milstar Master Control Center (MMCC). The overall approach to evaluating communications performance will be to establish and test communications networks which are as representative as possible of networks required in the Joint Milstar Communications and Control Operations Concept, the Milstar joint requirements document. The network testing will evaluate terminal interoperability (terminals of all three Services) and system connectivity, including satellite crosslink connectivity, in realistic network communications scenarios. Mission control will be evaluated in terms of its capability to support satellite constellation health and welfare and to operate the overall system in a manner that supports operational mission requirements. Each Service will prepare and staff independent evaluation reports. In addition, the Services will prepare and staff a joint report consolidating the findings of all three Services.

3. (U) System Characteristics:

<u>Characteristic</u>	<u>Objective/Threshold</u>	<u>Demonstrated</u>
(U) Survivability		
(• Jam Resistant	[] Future Tests
(• Low Probability of Intercept		
(• Nuclear Scintillation		
(U) Performance		
(• Capacity	[] Future Tests
(• Constellation Time Control		
(• Constellation Ephemeris Control		
(U) Mission Control Element (MCE) Mean Time Before Failure	600 hours	Future Demonstration

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4. (Current Test and Evaluation (T&E):

T&E Activity (Past 12 Months)

<u>Event</u>	<u>Planned Activity</u>	<u>Actual Date</u>	<u>Remarks</u>
Mission Control Element:			
[]	[]	Continuing Program
L			Continuing Program
Satellite:			
[]	[]	Continuing Program
			Continuing Program
			Continuing Program
Mission Control Element T&E			
Identify OT&E Platforms	FY 87	FY 88	
Complete Test Program Outline (TPO)	FY 88	FY 88	
Multiservice T&E			
Brief Multiservice Test Approach	FY 88	FY 88	Briefed OSD DOT&E
Complete Multiservice Test and Evaluation Master Plan (TEMP)	FY 87	FY 88	Currently in coordination with Services

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T&E Activity (Next 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
Mission Control Element		
L]	[]
Satellite		
L]	
Mission Control Element		
T&E		
Complete Test Approach	FY 89	
Revise TPO	FY 88	
Revise TPO	FY 89	
Multiservice T&E		
Complete TPO Outline	FY 89	
Complete multiservice test approach	FY 89	